

Penn Cambria Curriculum

Course Name	Honors Chemistry I
Length of Course	<i>1 credit (1 period per day for one semester)- Weighted at 1.05 for GPA calculations</i>
Grade Level	10-11
Prerequisites	85 % or above in Algebra II
Course Description	This is a more rigorous course that includes the same curricular content as Chemistry I. However, this course will include a more in-depth study with class discussions, written analysis and outside readings. Honors Chemistry I stresses chemical mathematics; therefore, a thorough foundation in algebra is essential. Students must take Honors Chemistry 1 in order to meet the prerequisite for dual enrollment college credit in Honors Chemistry II.
Units of Study	Introduction to Chemistry Scientific Measurement Atomic Theory Periodic Table and Periodicity Chemical Bonding Chemical Formulas and Nomenclature Chemical Quantities and The Mole Chemical Reactions and Equations Stoichiometry Gases
Materials	Text: Modern Chemistry; Holt, Rinehart, Winston; ©2008 Supplemental Materials: lab materials and supplies

At Penn Cambria High School, all core subject courses are aligned to the Pennsylvania Academic Standards and focus on ensuring students have a solid understanding of core concepts. In addition, all courses encourage critical thinking and an in-depth analysis of subject matter in addition to building a strong foundation. The primary goal of the honors level curriculum alternative for these core courses is to provide students with a more in-depth study of the concepts by deepening the academic study and more academic reading. Students in the honors level of a core course will be expected to engage in analysis, evaluation and synthesis level activities with more frequency and for a longer duration than that found in the non-honors level course.

Students in Honors Chemistry will not only learn physics concepts, but also be expected to apply, analyze and evaluate these concepts in real and simulated scenarios.

Unit 1: Introduction to Chemistry

Estimated Time: 1.5-2.5 weeks

Standard Alignment:

3.1.12. D – Analyze scale as a way of relating concepts and ideas to one another by some measure.

3.4.12. A – Apply concepts about the structure and properties of matter.

3.4.12. B – Apply and analyze energy sources and conversions and their relationship to heat and temperature.

Curricular Objectives:

Students will:

- a. Utilize the scientific method in solving.
- b. Classify matter as an element, compound, or mixture; homogenous or heterogeneous.
- c. Distinguish between chemical and physical changes/properties.
- d. Observe chemical reactions, stating the evidence to the change.
- e. Describe energy changes in a chemical reaction.
- f. State the chemical symbol, and chemical/physical properties of 40 common elements.

Assessments/ Measurement of Objectives:

- Classification activities
- Lab observations/ reports
- Objective quizzes / test based on objectives
- Prediction, and data collection / analysis assessments

Suggested Methods of Instruction / Learning Activities:

- Guided practice (in/out of class)
- Classifying matter activities
- Classifying changes activities
- Chemical symbols reviews
- Physical/chemical classification activities
- Properties of elements lessons
- Laboratory Experiments/Reports
 - Evidence of chemical changes
 - Paper chromatography
- Outside Readings:
 - Green Chemistry
 - Lead's Toxicity

Unit 2: Scientific Measurement

Estimated Time: 1.5 weeks (1 week instruction + ongoing application)

Standard Alignment:

3.7.12. B – Evaluate appropriate instruments and apparatus to accurately measure materials and processes.

Curricular Objectives:

Students will:

- a. Distinguish between qualitative and quantitative measurements and the accuracy and precision of a measurement.
- b. Utilize the metric system of measurement.
- c. Convert between units within the metric system.
- d. Apply the rules of significant digits to scientific calculations.

Assessments/ Measurement of Objectives:

- Lab observations/ reports
- Objective quizzes / test based on objectives
- Classroom activities based on objectives

Suggested Methods of Instruction / Learning Activities:

- Guided Practice (in/out of class)
- Qualitative/quantitative measurements activities
- Accuracy, precision and percent error activities
- Prefixes/conversions in the metric system activities / lessons
- Laboratory Experiments/Reports
 - Mass/volume/length measurements and conversions in the metric system.

Unit 3: Atomic Theory

Estimated Time: 2.5-3.5 weeks

Standard Alignment:

3.1.12. E – Evaluate change in nature, physical systems and man made systems.

3.4.12. A – Apply concepts about the structure and properties of matter.

Curricular Objectives:

Students will:

- a. Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., protons, neutrons, electrons).
- b. Determine the number of subatomic particles in an atom of a given element.
- c. Define an isotope and write their representations.
- d. Calculate average atomic masses, using isotopic data.
- e. Explain the relationship between the physical properties of a substance and its atomic structure.
- f. Describe the contributions of Thomson, Rutherford, Bohr, Schrodinger to atomic structure.
- g. Utilize the Aufbau Principle, Hund's Rule and the Pauli Exclusion Principle to complete electron configurations of atoms.
- h. Complete Lewis dot notations of atoms.
- i. Compare and analyze types of waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, x-rays, microwaves) as it relates to their properties, energy levels and motion.
- j. Identify metallic ions in flame tests.
- k. Observe and identify atomic spectra using spectroscope.
- l. Apply Beer's Law to analyze spectrophotometric data.

Assessments/ Measurement of Objectives:

- Lab observations/ reports
- Objective quizzes / test based on objectives
- Classroom activities / projects based on objectives

Suggested Methods of Instruction / Learning Activities:

- Guided Practice (in/out of class)
- Timeline of atomic theory/structure lesson and activity
- Properties of subatomic particles classroom activities
- Subatomic particles in a given element exercise
- Isotope representations class activity
- Atomic mass calculations lesson and practice
- Laboratory Experiments/Reports
 - Isotopic pennies
 - Law of conservation of matter
 - Qualitative identification of metals by flame tests
 - Spectrophotometric determination of copper ions in solution
 - Observation/identification of atomic spectra
- Outside Readings
 - Strontium-90 in Baby Teeth
 - Beethoven and Lead Poisoning

Unit 4: Periodic Table and Periodicity

Estimated Time: 1.5-2.5 weeks

Standard Alignment:

3.1.12. C – Assess and apply patterns in science and technology.

3.4.12. A – Apply concepts about the structure and properties of matter.

Curricular Objectives:

Students will:

- Explain the origin of the periodic table, including the contributions of Mendeleev, Ramsey and Moseley.
- Distinguish among groups, families, series and periods of elements on the periodic table.
- Utilize the periodic table to complete electron configurations and Lewis dot notations of elements.
- Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table.

Assessments/ Measurement of Objectives:

- Lab observations/ reports
- Objective quizzes / test based on objectives
- Classroom activities / projects based on objectives

Suggested Methods of Instruction / Learning Activities:

- Guided Practice (in/out of class)
- Timeline of periodic table development
- Electron configurations and Lewis dot notations lesson and activities
- Physical/chemical property variation and prediction lesson and activities
- Laboratory Experiments/Reports
 - Periodic law (predicting density and solubility of group II/IV elements).

Unit 5: Chemical Bonding

Estimated Time: 1.5-2.5 weeks

Standard Alignment:

3.4.12. A – Apply concepts about the structure and properties of matter.

Curricular Objectives:

Students will:

- a. Distinguish between cations and anions.
- b. Recognize patterns of cation/anion nomenclature.
- c. Describe how ions form.
- d. Predict the type of ion formed by an element.
- e. Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent).
- f. Distinguish among single, double and triple covalent bonds.
- g. Draw structural formulas and Lewis dot structures of covalent molecules.
- h. Build and draw structural isomers of covalent compounds.
- i. Explain the relationship between the physical properties of a substance and its molecular structure.

Assessments/ Measurement of Objectives:

- Lab observations/ reports
- Objective quizzes / test based on objectives
- Classroom activities / projects based on objectives

Suggested Methods of Instruction / Learning Activities:

- Guided Practice (in/out of class)
- Ionic/covalent bonding reactions
- Drawing Lewis dot structures
- Laboratory Experiments/Reports
 - Building molecular models
 - Ionic/covalent properties

Unit 6: Chemical Formulas and Nomenclature

Estimated Time: 1.5-2.5 weeks

Standard Alignment:

3.4.12. A – Apply concepts about the structure and properties of matter.

Curricular Objectives:**Students will:**

- a. Write chemical formulas for ionic compounds, binary covalent compounds, binary acids, and oxy-acids given their names.
- b. Name ionic compounds, binary acids, and oxy-acids given chemical formulas.

Assessments/ Measurement of Objectives:

- Lab observations/ reports
- Objective quizzes / test based on objectives
- Classroom activities / projects based on objectives

Suggested Methods of Instruction / Learning Activities:

- Guided Practice (in/out of class)
- Writing chemical formulas activity
- Chemical nomenclature lesson and classroom activities
- Laboratory Experiments/Reports
 - Qualitative analysis of halide ions.

Unit 7: Chemical Quantities and The Mole

Estimated Time: 1.5-2.5 weeks

Standard Alignment:

3.4.12. A – Apply concepts about the structure and properties of matter.

Curricular Objectives:

Students will:

- a. Define a mole.
- b. Calculate the formula mass of a compound.
- c. Calculate the percentage composition of a compound.
- d. Determine the empirical formula and/or molecular formula of a compound.
- e. Convert between moles, particles and grams.

Assessments/ Measurement of Objectives:

- Lab observations/ reports
- Objective quizzes / test based on objectives
- Classroom activities / calculations/ projects based on objectives

Suggested Methods of Instruction / Learning Activities:

- Guided Practice (in/out of class)
- Conversion problems
- Formula mass calculations
- Percentage composition calculations
- Empirical/molecular formula determinations
- Laboratory Experiments/Reports
 - Percentage composition of foods (hotdogs and popcorn).
 - Mole relationships in the chemical reaction of iron and copper (II) sulfate.

Unit 8: Chemical Reactions and Equations

Estimated Time: 1-1.5 weeks

Standard Alignment:

3.4.12. A – Apply concepts about the structure and properties of matter.

Curricular Objectives:**Students will:**

- a. Write both a word and balanced, formula equation for chemical reaction.
- b. Include state symbols in an equation which describe the reactants and products.
- c. Classify a chemical reaction as composition, decomposition, single replacement, double replacement or combustion.
- d. Predict the products of a chemical reaction, utilizing an activity series and solubility chart when appropriate.
- e. Describe factors that influence the frequency of collisions during chemical reactions that might affect reaction rates (e.g., surface area, concentration, catalyst, temperature, agitation).

Assessments/ Measurement of Objectives:

- Lab observations/ reports
- Objective quizzes / test based on objectives
- Classroom activities / projects based on objectives
- Writing word and formula equations
- Identify reaction types

Suggested Methods of Instruction / Learning Activities:

- Guided Practice (in/out of class)
- Writing word and formula equations
- Identify reaction types
- Balancing
- Product prediction activities
- Laboratory Experiments/Reports
 - Reaction types/balanced chemical equations.

Unit 9: Stoichiometry

Estimated Time: 1-1.5 weeks

Standard Alignment:

- 3.1.12. D – Analyze scale as a way of relating concepts and ideas to one another by some measure.
- 3.4.12. A – Apply concepts about the structure and properties of matter.

Curricular Objectives:**Students will:**

- a. Interpret a balanced, chemical equation in terms of the mole relationships that exist between reactants and products.
- b. Solve stoichiometric problems.
- c. Determine the limiting reagent and excess reagent in a chemical reaction through stoichiometric calculations.
- d. Determine the percent yield of a chemical reaction through stoichiometric calculations.

Assessments/ Measurement of Objectives:

- Lab observations/ reports
- Objective quizzes / test based on objectives
- Classroom activities / calculations / projects based on objectives

Suggested Methods of Instruction / Learning Activities:

- Guided Practice (in/out of class)
- Stoichiometric calculations involving mole relationships, limiting/excess reagents, and percent yield of chemical reactions
- Laboratory Experiments/Reports
 - Stoichiometry relationship in the chemical reaction of zinc and hydrochloric acid (penny reaction)

Unit 10: Gases

Estimated Time: 1.5-2.5 weeks

Standard Alignment:

3.4.12. A – Apply concepts about the structure and properties of matter.

Curricular Objectives:**Students will:**

- a. Describe the movement, volume, attractive/repulsive forces, and collision elasticity of gas molecules as defined by the kinetic molecular theory.
- b. Explain pressure and temperature at molecular level.
- c. Define standard conditions of pressure and temperature.
- d. Convert between common units of temperature/pressure.
- e. Predict the behavior of gases through the application of laws (i.e., Boyle's Law, Charles' Law or ideal gas law)

Assessments/ Measurement of Objectives:

- Lab observations/ reports
- Objective quizzes / test based on objectives
- Classroom activities / projects based on objectives

Suggested Methods of Instruction / Learning Activities:

- Guided Practice (in/out of class)
- Boyle's law calculations
- Charles' law calculations
- Gay-Lussac's calculations
- Combined gas law calculations
- Graham's law calculations
- Laboratory Experiments/Reports
 - Boyle's Law ($PV=k$)